

cocoa-nut oil in butter. No reference, however, is made to the Müntz and Coudon method of estimating the latter adulterant.

These are but a few out of many points of interest which one notes on looking through the book. A number of new illustrations appear, including some, which might be improved upon, of lard, cholesterol, and phytosterol crystals. There are plenty of references to original sources, and the information generally is brought well up to date, several papers issued in the present year being laid under contribution.

"Adulteration," says Dr. Lewkowitsch, "has almost become a fine art." No doubt it has; and in the silent, ceaseless struggle between the cunning of the adulterator and the skill of the analyst such works as the present play an important part. They are very helpful to the former individual, certainly. But to the latter they are invaluable.

C. SIMMONDS.

STOKES'S MATHEMATICAL AND PHYSICAL PAPERS.

Mathematical and Physical Papers. By the late Sir G. G. Stokes. Vol. iv. Pp. viii+378. (Cambridge: The University Press.) Price 15s.

IT was on all grounds fitting that the continuation of this reprint should be entrusted to Prof. Larmor. The energy with which he has addressed himself to the work is shown by the fact that, although it is little more than a year since the death of his great predecessor, we already have a new volume in our hands, containing, in addition to the text, some valuable annotations and a selection from some very interesting correspondence.

The papers here reproduced range in date from 1853 to 1876; they are about forty in number, and, as a rule, are shorter and more restricted to special points than is the case in the previous volumes. There are, however, some notable exceptions. From the mathematical point of view the most considerable is the memoir "On the Communication of Vibration from a Vibrating Body to a Surrounding Gas." Perhaps the highest testimony to the excellence of this investigation is that Lord Rayleigh, who usually transforms and illuminates what he touches, in this case found, as he tells us, no better course open to him than to print page after page *verbatim* in his "Theory of Sound." The memoir is important, historically, not solely for the interest of the particular phenomenon which it explains, but as leading the way for a whole series of investigations in acoustics, optics, and electricity, in which we have to deal with waves diverging from point- or line-sources. Especially characteristic of the author is the labour expended with a view of reducing the results to a definite numerical form. From another point of view the paper may be regarded as forming one of the long series (some other members of which fall in the present volume) in which Stokes attacked the difficulties of the Bessel functions; other methods of dealing with these have since been devised, but it is mainly through his labours that these functions have become real and intelligible instruments of the mathe-

matical physicist, instead of merely abstract analytical expressions.

We also find in this volume the classical "Report on Double Refraction," presented to the British Association in 1862. This has entered into so many discussions, that it is unnecessary to refer to it in detail. Although elastic theories of light no longer excite the same interest, the report is still worthy of careful study, not only on intrinsic grounds, but also as a masterpiece of criticism, and as an embodiment of the clear and judicial mind of its author.

Among experimental investigations, we may note the very important paper "On the Long Spectrum of the Electric Light," and the verification of Huyghens's law of refraction in uniaxial crystals, which has served as a touchstone of optical theories.

A short, but extremely acute, paper "On the Effect of Wind on the Intensity of Sound," read before the British Association in 1857, was unfortunately unnoticed and forgotten until the explanation was rediscovered, and extended so as to include the effect of variations of temperature, by Osborne Reynolds in 1874.

It will not be supposed that the numerous other brief memoirs which we are obliged to pass over without special mention are unimportant. To the scientific worker the value of such a collection often resides chiefly in these minor investigations, which are otherwise in danger of being overlooked, as in the instance just referred to.

As has been already mentioned, the editor has appended a few notes, chiefly of a historical character. This delicate task has been exercised with great judgment and restraint. He has also included a most interesting correspondence between Stokes and Thomson on the early history of spectrum analysis. It is clear that long before Kirchhoff's first publication on the question Thomson was in possession of the leading ideas of the subject, and foresaw its wonderful possibilities, and that he had, moreover, publicly expounded these things in his lectures at Glasgow. But whilst he is emphatic that he derived his knowledge from Stokes, the latter is equally positive that his share in the matter was limited to suggestions which he had himself not been able to follow out with the same confidence. The whole correspondence is a lesson of magnanimity on both sides; we feel, as Lord Rayleigh recently expressed it, that the theory of spectrum analysis is practically there, but it would be contrary to the whole spirit of the friendly debate to attempt to analyse further how much of the merit of this prevision belongs to one rather than to the other. One point, however, remains indisputably associated with the name of Stokes, viz. the hypothesis that special absorption of light is due to coincidence, or approximate coincidence, of the period of the light waves with a proper period of a molecule. Hypotheses of this kind have played a great part in recent theories of anomalous dispersion and the like; but there can be no question as to their original source.

The remaining papers are to be included in a fifth volume, together with the biography by Lord Rayleigh recently issued by the Royal Society. We are also

encouraged to look forward to a selection from Stokes's scientific correspondence, which cannot fail to be of the highest interest.

All readers will combine in congratulating Prof. Larmor and the Cambridge Press on the success of this most acceptable volume. The portrait by Dickens, of date 1874, is admirable; we trust that it may be supplemented later on by a likeness of a more recent date, recalling the aspect which is to many more familiar.

HORACE LAMB.

ARGENTINE LIVE STOCK.

Argentine Shows and Live Stock. By Prof. Robert Wallace. Pp. 154. (Edinburgh: Oliver and Boyd, 1904.) Price 3s. 6d. net.

THIS volume is the outcome of a six months' tour of agricultural investigation and inspection in Argentina. While professing primarily to be an account of the annual live stock show of the Rural Society held at Palermo, it includes also notes on other Argentine shows, as well as an interesting description of the chief breeds of cattle, horses, and sheep bred in that country.

The European breeds of cattle represented at the Palermo show were the shorthorn, the Hereford, and the Aberdeen-Angus. Of these, the shorthorn cattle were far the most in evidence. We are told that this breed owes its success to its unrivalled capacity for beef-production where the climate is genial and pasture abundant, and to the fact that it has proved more serviceable than other imported breeds for crossing with the Criollo or native cattle, and so improving their quality for purposes of fattening. Hereford and Aberdeen-Angus cattle are stated to thrive well amid comparatively unfavourable surroundings, and, although not bred to nearly the same extent as the shorthorns, occupy a definite place in the rural economy of the Republic. The Aberdeen-Angus breed has not gained general favour partly because, unlike the other two breeds mentioned, it does not "nick" well with the Criollo cattle.

The horses at the Palermo show included all the more prominent British breeds, the introduction of which has been accompanied by considerable success. It is instructive to note that the importation has in many cases resulted in improvement, apparently owing solely to change of soil and environment. This is especially the case with certain strains of Hackney blood, while among cattle a similar tendency has been noticed for the Hereford breed.

Reference is made to the native Criollo horses, the degenerate descendants, according to most writers, of Barbs and Arabs introduced by the Spaniards at a very early period of the European occupation. Genuine Criollos—only now found in outlying provinces—are characterised by their dun colour, by stripes on the legs and shoulders, and by a dark dorsal band. These Criollos are said to be hardy to a degree, to possess great power of endurance, and, moreover, they are difficult to handle. Doubtless natural selection has been at work eliminating the unfit, with the result that the survivors present all the traits that Darwin

and others associated with the ancestors of the common horse. That in the Criollos the mane in no way differs from the mane of Barbs and Arabs suggests that many centuries must have elapsed since horses acquired a long mane, from which it may be inferred that Prjevalsky's horse is not an escaped domestic horse.

It is worthy of note that so great is the vigour of the Criollos that crosses with but little of the native blood prove most useful, owing to their great stamina and endurance.

The section on horses is followed by one on the sheep bred in Argentina. The account includes some interesting information about the early history of the Pampa and Criollo sheep, besides containing suggestions for the improvement of the stock now existing in the country. The Pampa is stated to be derived from the Spanish long-wool, which was a hardy animal, and, like the Dorset Horns of England, in favourable circumstances bred twice a year. The Criollo sheep is a "degenerate offshoot of the Spanish Merino." The most numerous and best represented sheep at the present time are the Lincoln and its various crosses, though a good many other British breeds have been imported with varying degrees of success.

Chapters on dairying and on agricultural machinery follow the description of the live stock.

The book is of value for the interesting descriptions which it contains, and because it affords an idea of the altogether remarkable resources of Argentina for producing live stock. It is freely illustrated by photographs of prize animals taken at the show in Palermo.

OUR BOOK SHELF.

The Old Riddle and the Newest Answer. By John Gerard, S.J., F.L.S. Pp. vi+293. (London: Longmans, Green and Co., 1904.) Price 5s. net.

WE have derived much entertainment from Father Gerard's lively chapters. They constitute an ably constructed plea for agnosticism in science. Not Huxley himself was so rigid in demanding exact demonstration of the truth of every statement required to be believed, as is this latest critic of the doctrine of evolution.

Science does not consist purely of mathematical demonstration. Other methods and processes have a perfectly legitimate place in scientific thought. Even in pure logic a door is open to theory and hypothesis; nor are probability, analogy, or even conjecture excluded by those whose conception of the science and art of reasoning is of the widest and wisest kind. We have, of course, to refrain from treating an untested hypothesis, however likely to be true, as an immutable verity; but no one in his senses will fail to recognise that among the dicta of scientific writers there are many degrees of probability, ranging from the practically certain to the merely conjectural. Some of the conclusions of science are as certain as the nature of things will allow; but it is a mistake to attribute to those who lay stress on such certainty a claim of equal respect for every position that to scientific men appears probable.

All this is, of course, perfectly well known to Father Gerard; we can only say that in practice he appears to disregard it. His book is marked throughout by great charm of style and felicity of expression; its main defect is a too evident desire to "play to the gallery." The chapters which contain a root-and-